



## Department of Civil Engineering and Engineering Mechanics Columbia University



Tuesday, November 13, 2012 (2:30-3:30 pm), Davis Auditorium

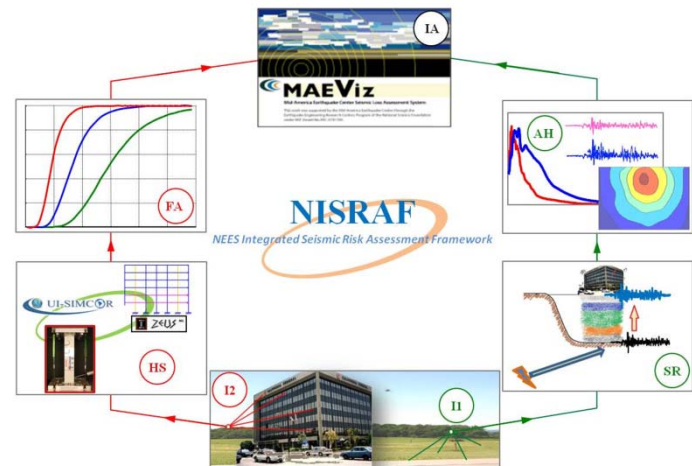
### EARTHQUAKE IMPACT ON THE BUILT ENVIRONMENT USING ADVANCED HAZARD ESTIMATION AND STRUCTURAL HYBRID SIMULATION

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**Abstract:** Estimation of the impact before, or shortly after, damaging earthquakes provides first responders and other planning, mitigation and response organizations with a unique opportunity to minimize the consequences on vulnerable communities. In this presentation, an integrated hazard-vulnerability system is described. The system, referred to as NEES Integrated Seismic Risk Assessment Framework (NISRAF) develops and implements advanced site response-based hazard mapping, use of free-field and infrastructure instrumentation, and advanced hybrid (analysis-testing) tools to provide refined estimates of earthquake impact.

The components of the system and their theoretical background are described, followed by application cases from the west coast of the USA as well as projections onto the impact on transportation systems in the Midwest region. NISRAF functions are all driven by a single graphical user interface that communicates with site response software, hazard mapping algorithms, deployed instrumentation, model updating tools, and testing equipment as well as fragility models and transportation network flow analysis to derive impact estimations of a level of accuracy not available before. The system is currently used in a couple of other locations around the world.



Fellow of the UK Royal Academy of Engineering Amr Elnashai is the Head of the Civil and Environmental Engineering Department, and Bill and Elaine Hall Endowed Professor at the University of Illinois at Urbana-Champaign, USA. He was Director of the NSF multi-institution interdisciplinary Mid-America Earthquake Center (2004-2009), and Director of the NSF Network for Earthquake Engineering Simulations (NEES) Laboratory at Illinois (2002-2009). Amr obtained his MSc and PhD from Imperial College, University of London. Before joining the University of Illinois in June 2001, Amr was Professor of Earthquake Engineering and Head of Section at Imperial College (1985-2001). He has been Visiting Professor at the University of Surrey, UK, since 1997. Other visiting professor appointments include the University of Tokyo, the University of Southern California (1990-1995) and the European School for Advanced Studies in Reduction of Seismic Risk, Italy.

He is founder and co-editor of the Journal of Earthquake Engineering and editorial board member of several other journals, a member of the drafting panel of the European design codes, past chair of the UK earthquake engineering association, UK delegate to and past senior Vice-President of the European Association of Earthquake Engineering. Amr's technical interests are multi-resolution distributed analytical simulations, network analysis, large-scale hybrid testing and field investigations of the response of complex networks and structures to earthquakes. He has produced more than 250 research publications, including over 130 refereed journal papers, many conference, keynote and prestige lectures (including the Nathan Newmark Distinguished Lecture), research reports, 2 books and several book chapters, magazine articles and earthquake field investigation reports.

He has contributed to major projects for a number of international companies and other agencies such as the World Bank, GlaxoWellcome (currently GSK), Shell International, AstraZeneca, Minorco, British Nuclear Fuels, Nuclear Installations Inspectorate, Mott MacDonald, British Airport Authority, Alstom Power, the Greek and Turkish Governments and the National Geographic Society. Amr enjoys scuba diving and reading on history, the history of painting and film-making.